0012251

START

ORIGINALLY MISPLACED DP 10/29/90

ENGINEERING CHANGE NOTICE

Page 1 of ~~8~~ 7

1. ECN 140503	Proj. ECN		
2. ECN Category (mark one): Supplemental [X]; Direct Revision [ ]; Change ECN [ ]; Temporary [ ]; Supersedure [ ]; Discovery [ ]; Cancel/Void [ ]	3. Originator's Name, Organization, MSIN, and Telephone No.: G. F. Williamson, 82920, R4-03, 3-5922		4. Date: 7-31-90
	5. Project Title/No./Work Order No. J8642: W-125 and B-714 Grout Disposal Facilities	6. Bldg./Sys./Fac. No.: 218-E-16	7. Impact Level: 2
	8. Document Number Affected (include rev and sheet no.): SD-714-FDC-001 Rev 2	9. Related ECN No(s).: 103639, 112890, 112851	10. Related PO No: NA
11a. Modification Work: [ ] Yes (fill out Blk. 11b); [X] No (NA Blks 11b, 11c, 11d)	11b. Work Package Doc. No: NA	11c. Complete Installation Work: Cog. Engineer Signature & Date	11d. Complete Restoration (Temp. ECN only): Cog. Engineer Signature & Date

12. Description of Change

Change description begins on page 3.

9112250 5309

13a. Justification (mark one)	13b. Justification Details
Criteria Change [X]	Justification is contained on the following pages.
Design Improvement [ ]	
Environmental [ ]	
As-Found [ ]	
Facilitate Const. [ ]	
Const. Error/Omission [ ]	
Design Error/Omission [ ]	

14. Distribution (include name, MSIN, and no. of copies) Sponsor Limited J. VanBeek

S. R. Briggs	R3-27	W. J. Powell	R4-03
R. D. Claghorn	R4-02	D. R. Pratt	T1-30
O. A. Halvorson	R3-09	T. W. Staehr	R3-27
G. W. Jackson	R4-01	A. R. Tedeschi	R4-02
J. R. McGee	S1-54	J. E. Van Beek	R3-27
R. L. Moxin	S4-43	G. F. Williamson	R4-01
D. R. Nunamaker	S5-04	M. W. Cline	R4-02
D. B. Powell	R4-03	J. S. Hill	H4-57
R. K. Sanan	R4-03	R. A. Karnesky	R4-03
		J. A. Voogd	R4-03

RELEASE STAMP

OFFICIAL RELEASE BY WHC DATE OCT 29 1990

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 140503

15. Design Verification Required	16. Cost Impact		17. Schedule Impact (days)
	ENGINEERING	CONSTRUCTION	
[X] Yes	Additional [ ] $ _____	Additional [X] $ 2.5 million	Improvement [ ] _____
[ ] No	Savings [ ] $ _____	Savings [ ] $ _____	Delay [X] 150

18 Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD	[ ]	Seismic/Stress Analysis	[ ]	Tank Calibration Manual	[ ]
Functional Design Criteria	[X]	Stress/Design Report	[ ]	Health Physics Procedure	[ ]
Operating Specification	[ ]	Interface Control Drawing	[ ]	Spares Multiple Unit Listing	[ ]
Criticality Specification	[ ]	Calibration Procedure	[ ]	Test Procedures/Specification	[ ]
Conceptual Design Report	[ ]	Installation Procedure	[ ]	Component Index	[ ]
Equipment Spec	[ ]	Maintenance Procedure	[ ]	ASME Coded Item	[ ]
Const. Spec	[X]	Engineering Procedure	[ ]	Human Factor Consideration	[ ]
Procurement Spec.	[ ]	Operating Instruction	[ ]	Computer Software	[ ]
Vendor Information	[ ]	Operating Procedure	[ ]	Electric Circuit Schedule	[ ]
OM Manual	[ ]	Operational Safety Requirement	[ ]	ICRS Procedure	[ ]
FSAR/SAR	[X]	IEFD Drawing	[ ]	Process Control Manual/Plan	[ ]
Safety Equipment List	[ ]	Cell Arrangement Drawing	[ ]	Process Flow Chart	[ ]
Radiation Work Permit	[ ]	Essential Material Specification	[ ]	Purchase Requisition	[ ]
Environmental Impact Statement	[ ]	Fac. Proc. Samp. Schedule	[ ]	_____	[ ]
Environmental Report	[ ]	Inspection Plan	[ ]	_____	[ ]
Environmental Permit	[X]	Inventory Adjustment Request	[ ]	_____	[ ]

19 Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below

Document Number/Revision	Document Number/Revision	Document Number/Revision
V-B714C2-003		
WHC-SD-WM-SAR-042		
DOE/RL 88-27, Grout Treatment Facility Dangerous Waste Permit Application, Part B Permit		

20 Approvals

Signature	Date	Signature	Date
OPERATIONS AND ENGINEERING		ARCHITECT-ENGINEER	
Cog./Project Engineer	8/9/90 8-7-90 7.31.90	PE	
Cog./Project Mgr	7.31.90	QA	
QA	8-1-90	Safety	
Safety	8/6/90	Design	
Security		Other	
Proj.Prog./Dept. Mgr	8/14/90		
Def. React. Div.			
Chem. Proc. Div.			
Def. Wst. Mgmt. Div.		DEPARTMENT OF ENERGY	
Adv. React. Dev. Div.		Approved via CR B-714-006 Rev 3	9/28/90
Proj. Dept.	8/9/90 8/1/90		
Environ. Div.	8/6/90 8/1/90 8/10/90	ADDITIONAL	
IRM Dept.			
Facility Rep. (Ops)	8/9/90 8/6/90		
Other			
Sponsor Limited	8/1/90		
J.E. Van Beek			

1. Add a section 2.2.14

Diffusion Cocoon Requirements

The function of the cocoon is to control the release of radionuclides and chemicals from the grouted waste disposal system to the environment. The cocoon functions in two important ways to provide this additional isolation and environmental protection.

- The long-term release of radionuclides and chemical constituents is delayed by decreasing the diffusivity of the barrier system. The function of the asphalt barrier is to provide an effective ionic diffusivity of at least $1 \times E^{-10}$ cm^2/sec, (reference 8).

- The asphalt concrete cocoon keeps water from entering the waste form. The high salt liquid tank waste is combined with a tailored blend of cementitious bulk solids to form a grout slurry which is placed in the vault for curing and disposal as a solid waste form. After the initial heat of hydration is completed, a longer term radiolytic heating will take place such that the grouted waste will be at an elevated temperature compared to the surrounding soil for hundreds of years. Eventually, the moisture in the soil column in the form of water vapor will be attracted to the high salt grouted waste once isothermal conditions are reached. The cocoon will serve as a water vapor barrier with vapor diffusivity of less than 2.9×10^{-5} cm^2/sec to prevent the return of moisture to the grouted waste (reference 8). This prevents the saturation of the grout and eventual release of contaminants due to "dripping" through the bottom of the disposal system.

2. Add a section 2.2.15

The cocoon is also to be designed to perform its intended function for a long time period. The disposal system is to be designed so that there is a reasonable expectation that performance of the undisturbed system does not exceed the dose limits outlined in DOE Order 5820.2A and Draft DOE-RL 5820.2A for 1,000 years after disposal.

Draft DOE-RL 5820.2A defines ALARA for long term protection. Reasonable effort shall be made to design disposal systems such that potential exposures are ALARA for all times up to the year of maximum exposure.

3. Add a section 2.2.16

Based on significant development work and performance assessments provided by others (WHC and PNL), the following design features and criteria are expected to satisfy the functional and performance requirements for the cocoon.

Use of an asphalt cocoon placed around all exterior surfaces of the vault and lower liner will provide the required degree of waste isolation from the soil column and ultimately the groundwater and fulfill the ALARA requirements for an estimated 10,000 year time frame.

- Asphalt composition shall be Grade AR-6000 and provided in a mix of 7.5 ± 0.5 weight percent asphalt.
- Aggregate shall consist of crushed stone or gravel with a size distribution as shown in Table 1.
- Aggregate shall be coated with an antistripping agent, 3 ± 0.5 weight percent lime, prior to asphalt addition.
- The asphalt mixture shall pass modified Texas Boil and Lottman (WSDOT 718) stripping tests using distilled water and a NaOH solution of pH 12.
- The asphalt mixture shall have a minimum compressive strength of 370 PSI at 90°C by ASTM D 1074-83 (or latest equivalent).
- For project W-125 the thickness of the cocoon shall be a minimum of 40 in. around all exterior surfaces of the vault and leachate collection system.
- Project B-714 shall have a minimum asphalt cocoon thickness of 18 in. under the vault catch basin, (reference 8) and shall be a minimum of 36 in. thick from the catchbasin bottom to the upper lip of the catchbasin. Asphalt cocoon thickness above the upper lip of the catchbasin shall be a minimum of 40 in. on all other exterior surfaces of the vault and leachate collection system.
- The asphalt mixture shall be compacted to provide uniform and continuous coverage around the vault system with a maximum of 4 percent voids. The permeability tests on compacted specimens are to be in general accordance with ASTM D3637.

Justification:

To provide functional criteria for a cocoon (barrier) to meet long-term performance requirements described in the Grouted Double-Shell Tank Waste Performance Assessment (reference 8).

TABLE 1
(Reference 6)

Grading in accordance with ASTM C 136.

- Amounts finer than each laboratory sieve (square-openings), weight percent.

Nominal Square Opening Sieve Size	Aggregate Percent
5/8 in.	100
1/2 in.	92 to 100
3/8 in.	85 to 95
No. 4	65 to 75
No. 16	35 to 41
No. 30	25 to 31
No. 50	14 to 20
No. 200	3.5 to 7.5

- Deleterious materials: Particles of specific gravity less than 1.95, maximum 1% by weight.

- Limits for fractured faces by percent weight: Minimum of 2 fractured faces on 85% and at least 1 fractured on 90% of material retained on No. 10 and above sieves.

4. Change existing section 2.7 to 2.8 and add a section:

2.7 GAS VENTING REQUIREMENTS:

Two small gas vents shall be provided from the lip of the catch basin through the cocoon to the soil column. The vents shall have a nominal inside diameter of approximately 0.1 in. to prevent pressurization and allow any accumulation of hydrogen due to radiolytic decay to escape from the waste disposal system to the soil column (reference 5). Other functional requirements include:

- Minimum design life 250 years
- Nominal diameter .1 Inch (I.D.)
- Minimum vent opening distance from vault barrier: 4-feet
- Minimum distance from any other potential void or area that would tend to concentrate the gas shall be 4-feet
- Ignition sources are to be eliminated from the vault catch basin and the soil, including the leachate sump.
- The vent should be approximately 1 inch in diameter at the soil and filled with pea gravel with a screen to keep the gravel in place.
- The hole in the diffusion break shall not be larger than .5 inch in diameter.

The location of the vents should be at the end of the vault opposite the leachate collection tank (one in each corner) and just above the lip of the concrete catch basin. The compressive strength of the vent tube shall be adequate to allow compaction of the asphalt barrier around the tube without collapsing the tube.

The ends of the tube should be connected to a nominal 1 inch diameter pipe with an abrupt entry of the tube into the pipe and a screen just beyond the exit of the tube to prevent clogging of the tube. The pipe section should be filled with appropriate material before installation to prevent clogging of the pipe and to reduce the pressure drop in venting to the soil.

The gas vent placement should be designed to prevent hydrogen gas build-up in any area that would tend to concentrate the gas, such as the diffusion barrier.

Design to Safety Class 2, as defined by WHC procedures. The two vents are redundant in that only one is required for operation.

Maximum pressure to be seen by the vent piping is less than 50 PSI.

Justification:

Over a period of time, radiolytic hydrogen can be produced from the grout waste as hydrogen gas. To prevent the gas from slowly building up and pressurizing the grout vault it is necessary to install small vents through the solid diffusion break. Gas will vent through this small exit with only small back pressures. The impact on the performance assessment of water vapor diffusing back through the vent is negligible. After 250 years the rate of gas generation will be small enough so that if the vent closes, the hydrogen can be released by diffusion through the solid asphalt diffusion barrier that surrounds the grout vault.

Add to Section 4.0:

. DOE-RL 5820.2A (Draft), "Radioactive Waste Management, July 1990

Add to section 6.0:

5. HGTP-90-02-01, "GAS GENERATION AND RELEASE FROM DOUBLE-SHELL SLURRY FEED (DSSF) GROUT VAULTS", G. A. WHYATT, December 1989 Draft.

6. Letter, W. J. Powell to Distribution, "Asphalt Diffusion Break and Barrier Material Properties," June 28, 1990.

7. SD-WM-CR-029, Rev. 2, "Design Criteria for the Grout Disposal Vault Ventilation System," April 30, 1990.

8. PNL Report, G. A. Whyatt, et. al., "Performance Assessment of Grouted Double-Shell Tank Waste Disposal at Hanford," June 1990 Draft.